

National Research Centre, Dokki, Cairo (Egypt)

Chemical and nutritional studies on roselle seeds (*Hibiscus sabdariffa* L.)

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With 1 table

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Roselle plant (*Hibiscus sabdariffa* L.) is cultivated in Egypt in small areas in different locations. This plant is of great importance as multi-purpose economic one. Roselle plant is grown for its calyx, pigments, fibres and oil, the roselle fibre is superior to that of jute. Its seeds as reported by *Georgi* (4) and *Shaw* (10) had high oil content which is similar to kapok and cottonseed oil. This plant increasing in importance has a promising future, and there is possibility of growing roselle in reclamation zones.

Now the quantities of roselle seeds produced which are not used for recultivation are of no economic value. This draws attention for evaluating these seeds for their chemical composition and nutritional value before and after extracting their oil content. Some constants of the roselle seed oil were also determined.

Material and methods

Roselle seeds (*Hibiscus sabdariffa* L.) were crushed and coarsely ground, then extracted with ethyl ether for separating the oil from the meal according to A.O.A.C. (1).

Chemical analyses for the unextracted and extracted ground seeds were conducted for determining moisture, crude protein, crude fat, crude fiber, nitrogen-free extract, ash and calcium respectively (A.O.A.C., 1). Phosphorus and sulfur were evaluated according to *Toth* et al. (12).

Feeding values of the unextracted and extracted roselle seeds were determined by conducting digestibility trials on four Rhode Island Red cocks using corn as basal ration according to *Selim* (9), where fecal protein was determined directly in the excreta according to the method of *Jakobsen* et al. (6). Deproteinizing with trichloroacetic acid, urinary nitrogen was determined by difference (excreta N-fecal N). Feeding values were calculated from the digestible nutrients as total digestible nutrients (TDN) in the usual manner (*Maynard* and *Loosli*, and *Morrison*, 8) and as starch value (SV) using the conversion factors cited by *Ghoneim* (5), i.e., 1.03, 3.11, 1.00 and 1.00 for units of crude protein, crude fat, nitrogen-free extract and crude fiber respectively. The deduction of crude fiber was 0.30 unit of starch value for each 1% crude fiber. Metabolizable energy (ME) was calculated for the unextracted and extracted ground roselle seeds by multiplying (TDN) figures by the factor 4.2 as suggested by *Titus* and *Fritz* (11).

Fat extracted from ground roselle seeds was dried at 100°, then iodine absorption number, saponification number, *Reichert-Meissel* and *Polenske* values determined according to A.O.C.S. (2).

Results and discussion

(I) Chemical composition and nutritive values of unextracted and extracted roselle seeds.

Table 1 shows the chemical composition, digested nutrients and nutritive values of unextracted and extracted ground roselle seeds. For the unextracted seeds the values of crude protein, digestible crude protein, total digestible nutrients (TDN), starch value (SV) and calculated metabolizable energy were 23.95%, 15.36%, 75.81%, 84.06% and 3184 kcal/kg, the corresponding values for the extracted seeds were 29.04%, 27.50%, 68.83%, 64.23% and 2891 kcal/kg. The higher nutritive values of the unextracted seeds than the extracted ones are due to the higher percentage of fat in the unextracted seeds. For the unextracted seed the higher value of starch value (SV) than the total digestible nutrients (TDN) is due to the high correction factor of fat, i.e., 3.11 cited by *Ghoneim* (5) for computing the starch value. Generally the roselle seeds are high in fat, protein and nutritive values, also the extracted seeds are a good source of digestible protein and total digestible nutrients. In this connection *Georgi* (4) and *Shaw* (10) reported that roselle seeds had high oil content which is similar to kapok and cottonseed oil.

(II) Roselle seed oil constants.

The values of iodine number, i.e., the number of grams of iodine absorbed under standard conditions by 100 gm of fat, the saponification number, i.e., the number of milligrams of potassium hydroxide required to saponify 1 gm of fat, *Reichert-Meissel* value, i.e., the water soluble volatile fatty acids in the fat and the *Polenske* value, i.e., the water-insoluble fatty

Table 1. Chemical composition, digested nutrients and nutritive values of unextracted and extracted roselle seeds (*Hibiscus sabdariffa* L.).

Items	Unextracted seeds	Extracted seeds
Chemical composition		
Moisture %	7.58	8.18
Crude protein %	23.95	29.04
Ether extract %	22.34	0.69
Nitrogen-free extract %	23.81	32.86
Crude fiber %	15.30	20.04
Ash %	7.02	9.19
Calcium %	0.31	0.41
Phosphorus %	0.60	0.79
Sulfur %	0.35	0.37
Digested nutrients		
Crude protein %	15.36	27.50
Ether extract %	14.40	0.68
Nitrogen-free extract %	22.52	32.51
Crude fiber %	5.53	7.29
Nutritive values		
Total digestible nutrients (TDN) %	75.81	68.83
Starch value (SV) %	84.06	64.23
Calculated metabolizable energy kcal/kg	3184	2891

acids in the fat as defined by *Cock* and *Van* (3) and *Williams* (13) of the roselle seed oil are listed below.

The above values are of particular importance in the examination of the fats and oils giving valuable information with regard to adulteration.

Iodine number	15.63
Saponification number	258
Reichert-Meissel value	1.75
Polenske value	1.14

Summary

Unextracted and extracted roselle seeds (*Hibiscus sabdariffa* L.) were analysed for determining moisture, crude protein, ether extract, nitrogen-free extract, crude fiber, ash, calcium, phosphorus and sulfur.

Digestibility trials with cocks showed that the digestible crude protein, total digestible nutrients, starch value and calculated metabolizable energy for the unextracted roselle seeds were 15.36%, 75.81%, 84.06% and 3184 kcal/kg respectively, the corresponding values for the extracted seeds were 27.50%, 68.83%, 64.23% and 2891 kcal/kg.

Iodine number, saponification number, Reichert-Meissel and Polenske values for the roselle seed oil were 15.63, 258, 1.75 and 1.14 respectively.

Zusammenfassung

Nicht extrahierte und extrahierte Rosellesamen (*Hibiscus sabdariffa* L.) wurden zur Ermittlung von Feuchtigkeit, Rohprotein, Ätherextrakt, stickstofffreiem Extrakt, Rohfasern, Asche, Calcium, Phosphor und Schwefel analysiert.

Verdauungsversuche mit Hähnchen haben gezeigt: Verdaubares Rohprotein, gesamte verdaubare Nährstoffe, Stärkewert und kalkulierte Werte für metabolisierbare Energie für die nicht extrahierten Rosellesamen waren: 15,36%, 75,81%, 84,06% und 3184 kcal/kg entsprechend. Die entsprechenden Werte für die extrahierten Samen waren: 27,50%, 68,83%, 64,23% und 2891 kcal/kg.

Iodnummer, Verseifungsnummer, Reichert-Meissel- und Polenske-Werte für Rosellesamen-Öl waren: 15,63%, 258, 1,75 und 1,14 entsprechend.

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